IDRC EXPERIENCE IN POST-PRODUCTION SYSTEMS RESEARCH, FOOD CROP UTILIZATION AND AGRO-INDUSTRIAL DEVELOPMENT

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Introduction:

Within the context of an increasingly tenuous world food situation and degradation of the natural resource base for production, the main concern of the Agriculture, Food and Nutrition Sciences Division of IDRC is access to food and other basic necessities for the individual through the sustainable use of renewable natural resources. This objective is pursued in a set of research funding programs involving Agricultural Economics, Animal and Crop production systems, Fisheries, Forestry and Post-Production systems. The last mentioned of these (PPS), and the first (AE), play a key integrative role in the division by helping understand and modify the post-harvest and market system into which the commodity production technology programs output enters.

The focus in this presentation will deal principally with experiences and initiatives of the PPS program. Some attempt will be made to relate these to potential IARC roles and contributions in post-harvest food utilization and agroindustrial development.

The Post-Production Systems Program:

The PPS program is guided by the following three objectives or criteria:

1. Access to more and better quality food by rural and urban poor on a stable, equitable, sustained basis;

2. efficient utilization of biomass and agricultural by-products as inputs to other production activities, especially in small and medium scale enterprises; and,

3. technology development and testing within the context of locally available human and environmental resources.

In this context, the focus for research project selection and other activities such as workshops and training is on relatively disadvantaged people as individuals,

households and their communities. Interactions pursued by PPS staff and encouraged in project researchers are two-fold:

1. Clear identification of beneficiary problems, needs and aspirations.

2. Substantive work with the research and scientific community on technology and organization options which can be modified and tested to find realistic solutions to problems raised in 1, and to create new opportunities.

The emphasis is clearly on people first and then on technology or commodity as it relates to their needs and situation.

The methodology and approach required to do this effectively is evolutionary at this point. It involves much more cross disciplinary interaction than most researchers are used to or comfortable with. This is particularly true of socio-economic aspects of problem and opportunity identification. Rapid Rural Appraisal (RRA) and market research techniques (these have considerable overlap) are being actively explored in post-harvest applications.

Food production and post-harvest activities in most developing countries involve a large number of small enterprises which prepare process, store, distribute and market food products as well as supply other goods and services as inputs to the production process. These enterprises provide jobs for more than half the industrial labour force in most developing countries. Emphasis in the PPS program is therefore given to improvements in the processes, technology and organization of these enterprises. Based on the belief that latent entrepreneurial spirit exists in most societies, although not always expressed in ways we of the north expect, a search for effective ways of establishing and sustaining new enterprises are part of the program. More efficient use of available labour, higher return on investment, improvement in product quality, reduced drudgery in the workplace, and new product development and introduction are among the research objectives in this context.

Food production, harvesting, processing and final preparation for consumption is most frequently in the hands of women. Every effort is made to encourage consideration of the role of women and their needs at the problem - identification stage. The potential effects of proposed changes in processes and technology on women's work and well-being are then evaluated in the assessment of PPS-supported projects.

A Food System View

It is important to place the activities normally associated with the post-harvest and market system in a total food system perspective. A very simple illustration is shown in Figure 1. The post-production and market system occupies a key position between producer and consumer. Through this system messages are transmitted about consumer demand and producer supply over time and by location. The system also provides a range of services to both producers and consumers and, through processing of raw agricultural commodities, produces modified products with characteristics often vastly different from the initial material. These activities and underlying technologies are described in more detail in the background papers for this meeting. Those included in the diagram are simply indicative of major groups of post-production functions. The lower box indicates some of the many criteria which the products of the post-production system must meet to satisfy consumers and which must be reflected back to producers in terms of what raw materials are required.

Of course, this system does not work in total efficient harmony even in the most integrated economies. For the most part in developing countries there are discontinuities, lack of communication and infrastructure, incomplete information, and very local markets. Nevertheless the model is useful in putting things in perspective. Research and development related to the food system is so dominated by the commodity production perspective that the essential role of the post-production sector is easily ignored or assumed away by agricultural researchers concerned with food problems.

There is one more essential aspect to the food system

picture which bears emphasizing. The whole post-production and market system does not operate in a vacuum but in the context of a national and international policy environment. Decisions made and pressures brought at this level have a great deal to do with who in society will benefit most, what prices will be paid, and what products can viably be produced, manufactured and distributed locally, regionally and nationally. Imports, exports, subsidies, urban vs rural demands and a host of other more political decisions impinge on the consumer post-production/market - producer system interaction.

The processing, culling and distribution of agricultural commodities often produces large quantities of by-products and low quality materials not suitable for human consumption but quite adequate as is, or with modification, for animal feed and other uses. This additional utilization of total biomass produced is frequently overlooked in terms of its value to producers and in deciding on research priorities for improved production technology. In some cases, the by-product may be more valuable than what is considered the principle product from a human food perspective.

Post-Production Systems Research

Very few developing countries have a national post-harvest technology program and policy or a substantive understanding of their own specific post-harvest research needs. In some cases agricultural research programs have a post-harvest component, usually in the Agricultural engineering department, as a relatively minor activity. Related work in universities is usually compartmentalized by discipline. Extension programs are rare. On the industrial side, industrial technology research centres tend to emphasize the needs of large industrial processes and have little interest in or links to the agricultural or rural sector.

Given this situation, the strategy of the PPS program has been to support research groups with interesting technology development proposals which can be related to small farmers and local processing. The researchers are encouraged to refine their definition of the research problem through contact with potential users, surveys and evaluation of what has been done elsewhere under similar

conditions. Where possible, economists and other social scientists are brought into projects at the diagnostic stage to assist in focusing technological research. More recently, some projects have attempted comprehensive approaches to: understand how the particular food commodity system is operating; identify problems and opportunities; design and carry out research accordingly; and, test the results in a pilot operation with the target population.

Many of the projects supported involve rural agroindustry or small-scale food enterprises and related technologies. The arguments for this focus are as follows:

- reduction of post-harvest losses through better drying, handling and processing often requires a dedicated service enterprise close to the point and time of harvest;

- an enterprise controlled by the producer or in which he/she has some equity interest is more likely to leave some of the extra value added with the producer;

- rural and village agricultural commodity based enterprises can make available for local consumption more food of wider variety and reduced seasonality;

- rural food enterprises can undertake primary processing operations to reduce weight and volume as well as stabilize raw materials for larger processing plants in urban areas thus reducing costs of transport, handling and losses;

- employment opportunities can be created in rural areas to provide greater cash incomes in local economies thus contributing to economic development;

- rural enterprises can play a key role in generating dynamic rural development as part of national and regional industrial development strategies.

The kind of analysis and research involved in this comprehensive approach to post production research has brought the program into much closer liaison with production research projects. While this adds to complexity in management, concept and activity, it has encouraged researchers to begin thinking about food systems and concomitant feedback and feedforward loops. Activities in the PPS sector are influenced and constrained by the production sector and vice versa in such factors as types and amount of commodities available, varietal characteristics, production costs, quality, usable by-products, etc.

A cassava processing project at CIAT (Best, 1988) supported by IDRC exemplifies the approach and its potential. A team from CIAT and two Colombian institutions was assembled to attack the many sided problem of how and under what conditions a new product, cassava flour, could be incorporated into the existing wheat flour milling system in Colombia and accepted by the baking industry. Some of the disciplines involved were agricultural economics marketing, agronomy, engineering, food science, and chemical and mechanical engineering. Many of the basic technologies had already been developed independently at CIAT or elsewhere and were incorporated or adapted to specific requirements as defined by preliminary analysis and feasibility studies.

A pre-feasibility study involved macro analysis of the Colombian wheat market paralled by compilation of information on cassava production, a wheat mill survey and a baker and consumer survey. Separately, but oriented by early findings of the above study, a village cooperative scale processing plant was designed and developed. Washing, peeling and cutting equipment, drying systems, milling equipment and storage conditions were evaluated and modified before being combined for pilot plant studies. Bakery product development involved cassava variety and harvest age trials, flour production, optimization of baking procedures and quality control and acceptability studies. Knowledge and hardware generated through this process was finally combined in a feasibility study involving on-farm trials, composite flour production cost determinations, and assessment of baker and consumer acceptance of the final products. The

whole system is presently being pilot-tested with a farmers' association, millers and bakers. This project and several other similar ones show that flexibility and special management skills on the part of the project leader are essential. Because all the skills and experience required are unlikely to be found in a single institution, working relationships with specialists at local universities and with private consultants can be beneficial and effective.

Lessons from the IDRC Experience

Although our experience is incomplete and fragmented, a number of observations can be made which are applicable to IARCs considering the place and content of post-harvest research in their programs.

1. The effective identification of relevant research problems and needs requires a well designed and executed diagnostic study both in the field and of existing literature. This study may need to be carried out by a different research group than those proposing technological research. Ideally it should be done together and RRA techniques are a good place to start. In new areas, a strategic overall study of the food and market system may be required to identify research entry points.

2. National post-harvest programs are weak or non-existent especially related to experience in technological, economic and marketing problems in rural areas. Research planning and management skills need to be developed and creativity encouraged.

3. Outside funding and support must be flexible and able to adjust to needs and research problems as they are uncovered. This is true of methodology as well when dealing with small enterprises and applied research.

4. In projects dealing with agroindustry improvement it is very unusual to find a research team in one institution which can deal effectively with all the topics. While researchers can be expected to expand the boundaries of their interest areas, there are

limits beyond which they become in effective. Researchers therefore need to recognize when to seek out assistance from other agencies and disciplines to help define and answer evolving questions. Some of this input can come from private firms specializing in market research, engineering design, plant design, group organization, machinery construction and food technology.

5. Applying the results of technology research at various scales of operation in rural, village, and peri-urban settings requires creativity in seeking out market and product niches not presently or adequately filled or recognized. Some options to be examined could include: partial processing in near-farm locations to provide more uniform and stable raw materials to urban plants leaving more by-products and waste materials in rural areas for animal feed or other uses; franchising small-scale processing plants in rural areas with marketing, technical backstopping and quality control managed by a specialized core group; contract processing and joint venture arrangements with urban based commercial plants; and, hiring of professionals to operate and manage rural plants on behalf of rural associations.

6. Research on rural small-scale industry is complex representing as it does a combination of many technologies and management skills. PPS support has focused initially on the technological aspects as these are the ones with which most researchers and their institutions feel comfortable and they provide a common starting point. Nevertheless, it is evident that the technological components are not always the most limiting factor. For this reason we have put considerable emphasis on methodology development, diagnostics and awareness of rural realities.

7. Research institutions may not be appropriate leaders in establishing and encouraging small food enterprises. Their input is essential but private commercial operations, NGOs or individual entrepreneurs will have a much closer feel for day to day operations and market demands penalties and

rewards.

8. Project management becomes a crucial factor in complex agroindustry research and development projects. The leader must be creative, flexible, able to handle people well and understand and integrate a wide range of disciplines. A non-researching director may be required able to oversee progress in many components according to a planned timetable and budget, and to promote productive interaction between team members.

Potential Role of IARCs

Within the context of a broad food systems framework, key entry or influence points for IARCs can be identified under the following points suggested by Best and which correspond to many of the IDRC experiences.

- Market orientation.
- Strategic thinking and research.
- Methodology adaptation and training.
- Integrate and Catalyze R&D.
- Continuity.

Market Orientation

The objectives and needs of the user of technology and its products must be clearly understood and defined. Assumptions about beneficiaries and their environment should be specified so that more precise research objectives can be set. It is important to identify clearly where in the system new technology is best introduced related to what are usually multiple objectives including improved food intake and variety, increased income, and job opportunities.

IARCs could, with existing resources, place more emphasis on market research to better identify product and process opportunities related to the rural and urban market sector with emphasis on low income consumer needs. This kind of information can be very useful for setting long term commodity development objectives as well as for post-harvest initiatives.

Strategic Thinking and Research

Food consumption patterns shift and change, even among low income consumers, as new knowledge and products become available to them. These changes may involve greater variety in diet, more processed and convenience foods, growing markets for snack foods, and demonstration effects of higher income class consumption patterns. It is therefore important to identify and assess new and expanding market potential as well as disappearing markets for IARC mandated commodities and associated crops and products.

Often, processes and products are location and environment specific. Identifying the basic or generic production and post-production technology around which variations can be evolved according to local needs and specifications could be very productive both for IARCs and NARs. Questions of potential synergistic linkages to other commodities, utilization of production and processing by-products, animal feed markets, and opportunities provided by new processing technologies could be evaluated. The application and testing of new biotechnology discoveries related to modifying agricultural products is likely to open up many new possibilities in exploring these horizons.

Methodology and Approach

Farming Systems Research and applied on-farm trials are well accepted as part of the IARC research domain and provide feedback on problem definition and performance of modified technologies under operating conditions. A parallel or analogous approach in the post-production system would improve the possibilities for interaction and definition of problems spanning both sectors. A possibility is to build on already existing knowledge of agro-climatic based production zones and consequent food systems. Within this context, the role and potential of a single commodity, or a combination of commodities, could be evaluated linking vertically from production through harvest, threshing, drying, handling, storage, processing and utilization. This approach will also involve combinations with staple cereals, legumes and root crops.

Integrate and Catalyse

As noted, post-harvest research capability in most developing countries is scattered throughout many institutions and departments in Ministries, Universities, specialized Institutes and the private sector. No dissemination and promotion structure exists as for agricultural production technology. This is especially true for the needs of thousands of small-scale urban and rural village post-production enterprises.

IARCs have an opportunity to promote greater linkages, strategic thinking and studies with researchers in these institutions associated with agricultural production research within a larger framework. Post-production research networks could evolve as components of already existing production related networks. Implicit in this structure are opportunities for training and national institution capacity development, focus and collaboration. They can encourage and promote a conceptual and organizational structure going beyond commodity and product development and promotion to food systems thinking.

Continuity

The ideas and approaches suggested will take time to develop in an evolutionary and experimental way. This requires a steady long term commitment and effort. Unfortunately, national institutions, especially in poorer countries, often can't or don't provide this longer term stability in personnel or priorities. A consistent continuation of basic commodity utilization problem definition, studies and training within a systems framework will assure maintenance of knowledge and a steady focus.

Finally, research on operational topics is as necessary as laboratory science. Pilot projects in both production and post-production sectors and their interaction are a crucial means of testing technology under real conditions. There is a role for selective IARC participation here as well, although most have hesitated to move into commercial level operations viewing this as a clearly national prerogative. IARCs could be instrumental in encouraging and structuring key

initiatives. Often confused with promotion or dissemination, pilot projects can be essential research efforts to fine tune and evaluate technology constraints, gain experience in organization, train national researchers and program managers as well as provide crucial information and impetus for full scale development projects to follow.

It is not intended to suggest that IARC based research programs launch into post-production programs on a scale to rival that of their production related activities. This is clearly not feasible nor viable. However, with some reorientation of existing resources and alliances it would be possible to incorporate a broader post-production systems perspective and strategy. This focus could serve both IARC and national programs alike in deciding how scarce research support resources can best be applied to solving problems and providing low income people more opportunities in the broader food system.

How all this can be incorporated into IARC programs in a realistic and effective way requires some creative thinking. Merely adding on more components to existing programs is not likely to adequately address the complex problems described above. One suggestion made to maintain the clearly demonstrated advantage of commodity focused programs in IARCs and concurrently play an active role as technology based development catalysts is to create semi-independent subsidiaries in IARCs to carry out this function. Such subsidiaries would have a relatively small staff with a mandate to develop and promote the kind of systems thinking, analysis, pilot testing, and networking described above based mainly on national institutions for their benefit. While this is not the place to explore the idea fully, the concern is to maintain an effective IARC focus while developing channels for broader food systems thinking and programming impact.

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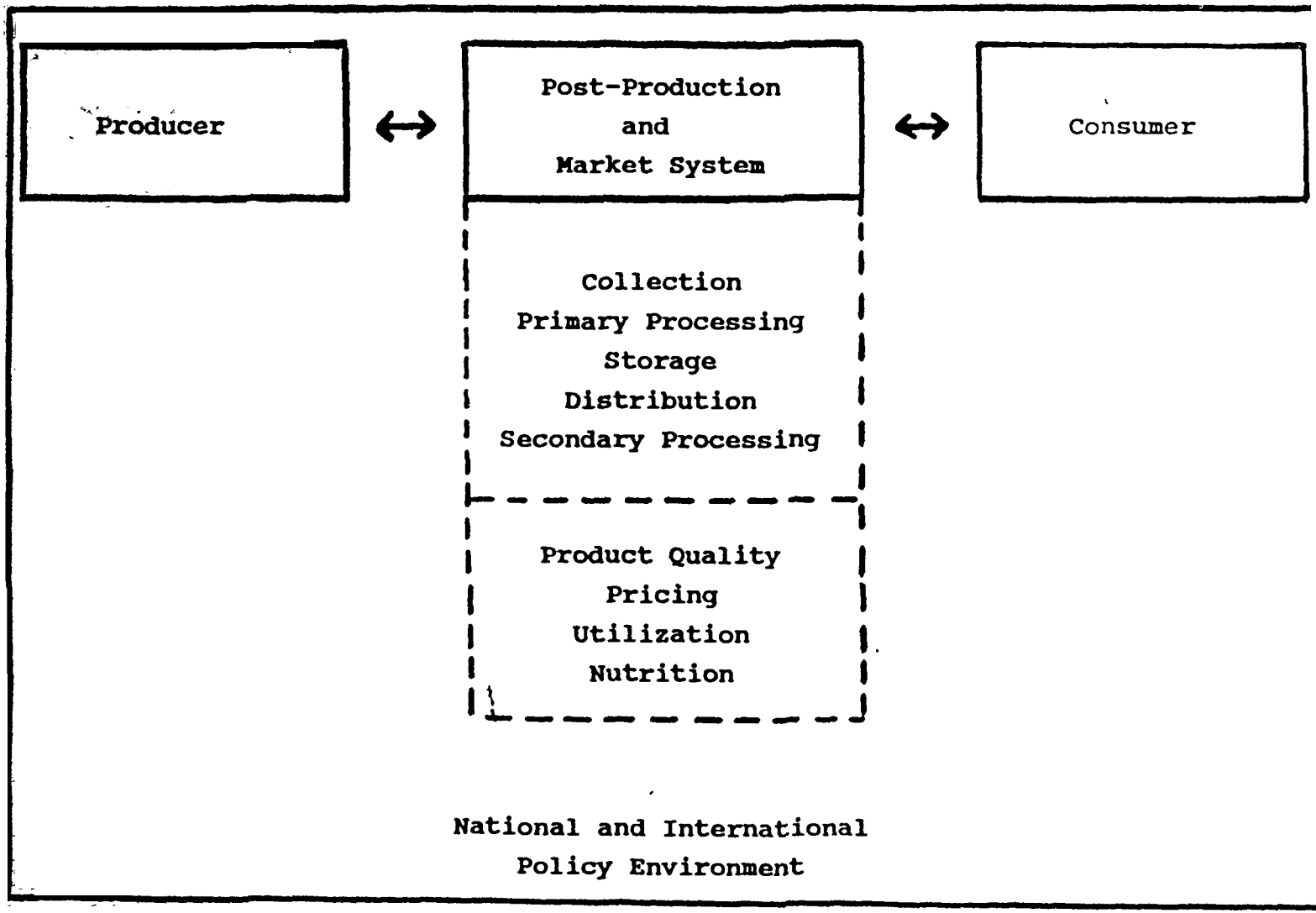

Figure 1

The Food Production and Utilization System